METHODS OF MAKING SMOOTH REINFORCED CEMENTITIOUS BOARDS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a Continuation application of U.S. patent application Ser. No. 10/696,751 filed Oct. 29, 2003 now U.S. Pat. No. 7,846,278; in turn a Continuation of U.S. patent application Ser. No. 10/155,650, filed May 23, 2002 now abandoned; in turn, a Divisional of U.S. patent application Ser. No. 09/478,129, filed Jan. 5, 2000 now abandoned.

FIELD OF THE INVENTION

The present invention relates in general to reinforced products and in particular to reinforced cementitious boards for building construction and methods of making such boards.

BACKGROUND OF THE INVENTION

Dry wall or gypsum board is commonly used in the erection of interior walls in commercial, residential and other building structures. Dry wall is effective when used to enclose rooms subject to normal humidity and surface moisture conditions that occur in many of the rooms commonly found in offices, shops, residences and other buildings. However, bathrooms, basements and certain areas of residential and commercial kitchens may pose potential moisture problems for interior walls constructed from dry wall wallboard.

When dry wall is used in bathrooms, for example, tile may be adhered directly to the dry wall. Alternatively, some bathrooms utilize prefabricated modular stalls and/or bathtubs which may be adhered to the dry wall in the bathing areas of the room. Because hot baths and, especially, hot showers produce steam, bathrooms are frequently exposed to periods of very high humidity. Additionally, the basins and bathing areas thereof are susceptible to localized collection of surface moisture in the form of small pools or puddles of water. If cracks are present in the tile grout or if the seams between the dry wall and the basins or prefabricated bathing area components are not completely sealed, the steam or puddled surface water may come into contact with the dry wall.

The opposed faces of dry wall are typically covered with paper which is suitable for receiving paints, primers and tile adhesives. However, such paper also has a tendency to absorb water. As the water is absorbed by the paper, it comes into contact with the gypsum core of the dry wall. Gypsum is a hygroscopic material. The gypsum core therefore absorbs moisture that passes through the facing paper. Over the course of time the level of water absorption may degrade the structural integrity of the dry wall board. If the water damage becomes excessive, some or all of the board may require replacement, which may be an especially laborious task in the bathing areas of a bathroom.

Because they are effectively immune to water damage, cementitious boards have been employed as alternatives to dry wall in particularly humid and wet rooms. Cementitious boards may be fabricated to assume essentially the same dimensions and weight, as well as support the same sorts of facing materials, as conventional dry wall. As is known, concrete and similar cementitious materials have far greater compressive strength than tensile strength. This phenomenon mandates that cementitious boards and similar, relatively thin, panel-like cementitious objects be handled with care during transport. More specifically, unless sufficiently substantially reinforced such boards must be carried vertically, i.e., with their opposed faces extending substantially perpendicularly to the ground or floor surface. This is especially true in the case of approximately ¼ inch thick boards that are typically laid over a plywood or particle board substrate and used to provide a smooth backing for receiving vinyl, tile or other flooring or countertop coverings. If carried substantially horizontally, i.e., with the opposed board faces extending substantially parallel to the ground surface such as would occur if opposite end edges or opposite side edges of the board are supported by two or more workers, the material in the upper regions of the board (in the thickness dimensions of the board) would be in compression and the material in the lower regions of the board would be in tension. If the tensile forces exceed the tensile strength of the cementitious material, the board may snap during transport. Alternatively, although less overtly catastrophic, radiant cracking may occur in the lower regions of the board which may preclude its installation or, if installed, might greatly comprise its bearing capacity and service life. Moreover, reinforcement should be of sufficient durability that it continues to strengthen and toughen the board over the typical projected 20 to 40 year service life of the board.

Various means have been proposed for reinforcing cementitious boards. Typically, the reinforcement comprises an open grid structure whose central plane is embedded approximately 1/32 to 1/16 inch beneath each face of the ordinarily ½ to ⅝ inch thick wall board or the ¼ inch backing board for vinyl, tile, or other flooring or countertop coverings. For example, open mesh woven polypropylene has been used for this purpose because of its resistance to water and the alkaline chemistries of Portland cement concrete and similar cementitious materials. However, because of the comparatively low modulus of elasticity of polyolefins such as polypropylene and polyethylene, which is on the order of about 10,000 to about 75,000 psi, such materials experience high strain under the tensile loads which can occur due to improper handling of the cementitious board. As tensile reinforcement, therefore, polypropylene grids are of limited practical use.

High modulus of elasticity materials have also been proposed for use as reinforcement for building panels. U.S. Pat. Nos. 5,552,207 and 5,763,043, for example, describe wall facings comprising an open grid, resin impregnated, fiberglass fabric which is affixed to a rigid foam insulation board and covered by and embedded within stucco or stucco-like material. The wall facing may be prepared either in situ on the outside of a building, or in the form of prefabricated panels which may be bonded to a building wall. The wall facing, including the prefabricated panel embodiments thereof, is attached to a pre-existing wall and is not itself used as a wall panel in the manner, for example, of dry wall or the cementitious boards of for the present invention. Indeed, the wall facing may be affixed to dry wall or cementitious boards but cannot be used in lieu thereof because of the low bending strength of its plastic foam backing board. A wall constructed solely of such facing would likely be destroyed as a result of minor impacts there against, including the sorts of impacts routinely absorbed by dry wall and cementitious wall panel boards. Because of the rough-textured finish and thorough coverage afforded by the stucco material, comparatively heavy and inexpensive fiberglass yarns arranged at an average of 3 to 10 ends per inch are used for the rovings or yarns.

As noted hereinabove, the reinforcement provided in existing cementitious boards is typically embedded just beneath each face of the boards. By locating the reinforcement so close to the surface of the board faces, the tensile stress transfer from the concrete to the reinforcement is optimized. It is concrete material which is closest the board faces, i.e., the